

A Modification of Results of the Osteological Analysis of the Norwegian Expedition to Easter Island

Scott J. Baker and George W. Gill

Introduction

Since the Norwegian Expedition to Easter Island in 1955-56, led by Thor Heyerdahl, University of Wyoming anthropologists have been involved in archaeological and osteological research on the island. The late Dr. William Mulloy, University of Wyoming anthropologist, was a member of the original team of professional scientists selected by Heyerdahl. He maintained a strong and enduring commitment to continued research there until his death in 1978. Today, his students and colleagues continue much of his pioneering work.

The first well documented skeletal remains from Easter Island were collected on the Norwegian Expedition by Mulloy and Smith in 1956 and described by Rupert Murrill (1965:68). Due to the opportunities for recovery of many more skeletons from the island, and the active destruction of exposed remains following the advent of regular air travel in the 1960s, an international expedition was organized in 1981 with the purposes of burial recovery and human osteological investigation (Gill 1981; Gill et al. 1983). Preliminary reconnaissance was accomplished in 1979 with a field trip to the island. During that time a sample of 100 individuals, which had been previously recovered by Sergio Rapu and Sonia Haoa, from the seaward side of Ahu Nau Nau were examined. This effort was followed by the full-scale intentional research effort two years later, funded by the National Geographic Society, the Center-for Field Research-Earthwatch, the Government of Chile and other agencies. This Cooperative investigation, known as the Easter Island Anthropological Expedition, resulted in the excavation and study of 308 human skeletons of the Late Prehistoric and Protohistoric Periods from 19 coastal sites (today $n=426$ from 20 sites). Much of this larger sample is only now being studied and metric results are so far limited to a preliminary examination of only five measurements. Therefore, the bulk of this preliminary analysis is obtained from the examination of adult skeletal material from the Ahu Nau Nau sample (total of 25 males and females).

Methods

Osteometric and anthroposcopic data were recorded in the Easter Island field laboratory on a standard 3-page checklist. These include a page of measurements which were compiled in consultation with osteologists working elsewhere in Polynesia and North America, as well as a page of 77 anthroposcopic observations (largely discrete), mostly of the cranium.

By the end of the 1981 field season, the second author began a preliminary analysis of the material from Ahu Nau Nau (Gill n.d.). In the course of analysis, he noted some particular discrepancies that led to the present study. The calculations of means on several selected cranial measurements showed values close to Pietrusewsky's Hane Dune collection from the Marquesas Islands (Pietrusewsky 1976),

but deviated somewhat with Murrill's Easter Island results from his 1968 study. These deviated in cranial/facial dimensions for both males and females, as well as a sex ratio of 4 to 1 (21 males to 5 females), as opposed to the nearly equal distribution found in our much larger study (15 males to 10 females at Ahu Nau Nau and 70 males to 65 females in the broader sample: Gill and Owsley 1993).

Because of these unexplained discrepancies the authors planned a visit, at the end of the 1981 field season, to the National Museum of Natural, Santiago, Chile, where the Easter Island skeletal remains from the Norwegian Expedition are currently housed. Our reevaluation proved valuable for several reasons. First, we found that Murrill's measurements were exceedingly accurate and that the inter-investigator error, or variation in technique, did not account for any of the differences.

Despite our confidence in Murrill's measuring ability, we did strongly suspect, however, that some of his female crania were misassigned into his male sample. Within a sample of only 26 adult crania, we felt that this could account for not only the skewed sex ratio of his sample but also serve to lower the craniometric values of both the males and the females.

The methods that we employed to ensure that our own reassessed crania were properly sexed were as follows:

1. Both authors judged sex of all remains independently of one another based on visual criteria of the cranium.
2. The Giles and Elliot (1962) discriminant function test for sex determination was then applied to all questionable crania.

It should be noted here that both authors had just concluded six months in the field laboratory on Easter Island examining the remains of 308 skeletons and this experience served to calibrate our cranial sexing methods with results obtained from associated postcranial material which was more diagnostic of sex, often including complete pelves.

Since no data exist concerning the accuracy of the Giles and Elliot method for determining sex from Polynesian populations, we first attempted to verify the accuracy of this method by applying it to a sample of complete, or nearly complete, skeletons from which the sex was felt to be certain from visual criteria of both the cranial and post-cranial remains. In no cases did conflicting results occur between our evaluation and the Giles and Elliot method. We therefore gained considerable confidence in the method for establishing sexual identity from Easter Island crania.

It should be noted that the Giles and Elliot 1962 method proved more effective than the later "refined" methods (1963 and Giles 1970) possibly due to the fact that the earlier technique attempts to distinguish sex independently of specific racial characteristics while the later methods attempt to refine accuracy by applying weighted discrimination function formulae to individuals of known race. The sexing ability of the discrimination function formulae is enhanced by incorpo-

rating diagnostic attributes of race beforehand. Understandably, this would hinder the ability to sex Polynesians accurately due to the fact that the diagnostic attributes of cranial morphology differ between major geographic races and traits which have been proven to be sexually diagnostic for other races may or may not apply to Eastern Polynesians. Therefore, the Giles and Elliot 1962 method was selected as the most accurate metric method for determining sex from the crania.

It should be noted here that Murrill had few of the advantages that we enjoyed for determining sex from the skeleton. Although there was an abundance of post-cranial material from all three sites, with the exception of several individuals from Ahu Tepeu (Site G1-2), most were so badly decomposed or disassociated that comparison with cranial remains was nearly impossible.

"Continual disarrangement of earlier by late burials was the characteristic development, so that at the time we excavated the site the picture was one of stones intermixed with bones on the ramp with no way of separating individual bundle burials. The bones were thus taken out as we came to them. Most were so badly decomposed that they were useless for measurement and observation" (Mulloy, personal correspondence, in Murrill, 1968).

Although the Giles and Elliot method for determining sex from crania was available to Murrill, we can only assume he chose not to use it due to its untested validity for sexing Polynesians.

The initial sample of 26 adult crania from the Norwegian Expedition collection was further depleted by one individual due to very strong evidence which indicates that he was not of unmixed Rapa Nui ancestry (Owsley, Gill and Owsley 1994). Multivariate discriminant analysis of craniometric data plus the application of reliable forensic techniques, indicate that individual #6 from Ahu Hekii has many Caucasoid features and is an example of European admixture. Because this report is primarily concerned with documenting and comparing physical traits characteristic of pre-contact Easter Islanders, individual #6 was omitted from statistical analysis.

Results

A remeasurement of Murrill's specimens, for all 28 craniometric values that were the same between his osteometric list and ours, revealed only one measurement error. This was a 10 mm error in facial height that seems to represent a typographical error. We therefore established confidence in the accuracy of Murrill's osteometrics.

Upon evaluation of the Norwegian Collection, both authors were able to agree, based on anthroposcopic criteria alone, on the sex of all individuals present. In six of the 25 crania examined however, we both disagreed with Murrill's evaluation and in all cases we believe he erred toward classification of large females as males. This determination has been strongly supported by the Giles-Elliot test for 5 of the 6 cases, with values averaging 11.7 points into the female range. These five we feel justified in reclassifying as females. The remaining individual we have also reclassified as such due to the fact that the only typically non-feminine trait, the rugosity of the occipital, we have found to be relatively undiagnostic of

sex, being observed in high frequency on females as well as males among pre-contact Easter Island skeletons.

Retabulations thus far have been completed on 10 of the more important of the 28 measurements in common between his study (Murrill 1968) and ours. These are illustrated in Tables 1- 4. As demonstrated by Table 5, the inclusion of the six largest females into the male category served to increase the mean values of very nearly every measurement for both male and female crania, making the results more compatible with the data obtained from Ahu Nau Nau (Gill 1981) as well as Pietrusewsky's Marquesan sample.

A more recent compilation of our much larger sample (N=308), Gill and Owsley 1993), which has been completed on only 5 of the 10 comparable measurements thus far, shows an even closer fit between Murrill's reassessed sample and our own, as well as marked similarity between Easter Island and the Marquesas (Tables 6 and 7). The similarities become even more striking when compared to other population samples from Peru (Howells 1973), Hawaii (Snow 1974) and North American Arikara (Bass 1964).

Lastly, Murrill's skewed sample of 20 males and 5 females is now 14:11, a closer approximation of the nearly equal distribution of sexes found at other Easter Island sites.

Conclusions

In conclusion, due to the exceedingly large dimensions of some protohistoric Easter Island crania, and the occasional rugosity found on a segment of the larger females, we believe that Murrill, in his classic study of the Norwegian Expedition skeletal collection, mis-sexed six of the largest females. The inclusion of their metric values in the male sample as well as the individual from Ahu Hekii which is now believed to be of European admixed ancestry, had the effect of slightly lowering the mean values of both samples, producing the false impression that Easter Islanders are smaller in cranial and facial dimensions than Marquesan islanders.

After reassigning sex to the six disputed crania, and retabulating craniometric means, the Murrill sample appears to fit more closely the results of our own much larger study and all samples appear closer in craniofacial metrics to the Marquesas Islanders.

The Marquesas Islands have been proposed before as a likely homeland for the ancestors of the Easter Island people based upon archaeological and linguistic evidence. Much more osteological analysis lies ahead before a definitive statement regarding origins and relationships can be made. However, at this stage, based on our preliminary osteological analysis, it appears that a strong affinity exists between Easter Island and the Marquesas group. The more difficult question of a possible thread of non-Polynesian ancestry within the ancient Easter Island population is clearly beyond the scope of this brief paper and is in no way precluded by the evidence presented here.

Table 1
Murrill's Male Crania (N=22)
Measurements in millimeters

Site	ML	MB	BB	MF	NA	BZ	NH	NB	OH	OB
TE-1	193	(132)	141	100	72	(131)	58	30	37	38
TE-2	179	132	141	92	60	(121)	47	25	32	36
TE-3	189	131	140	91	67	(127)	54	28	33	38
TE-6	195	129	141	92	71	133	59	27	37	(39)
TE-7	(179)	---	---	---	---	---	---	---	---	---
TE-2- *G1	180	135	153	---	---	---	---	---	---	---
HE-1*	185	128	---	91	70	---	49	26	35	40
HE-2	198	134	142	96	72	141	53	27	36	39
HE-3	194	129	145	100	71	135	55	28	34	40
HE-4	202	140	143	95	(66)	140	(54)	28	34	40
HE-5	186	134	142	101	64	131	48	25	30	40
HE-6*	176	138	132	96	76	134	60	25	37	38
HE-7	188	139	142	99	59	122	43	25	33	28
HE-8	184	129	139	94	66	(126)	50	28	33	39
HE-9	182	(124)	142	94	(67)	125	50	25	35	37
HE-10*	175	131	131	90	60	---	45	---	---	---
VI-1	186	133	148	94	71	136	57	28	35	40
VI-2	202	131	150	94	---	(140)	52	27	33	40
VI-3	184	137	144	88	63	127	46	26	32	37
VI-4	195	---	147	---	(72)	---	54	27	34	41
VI-5	181	128	134	89	---	129	52	27	33	38
VI-6	185	129	137	94	67	(127)	49	26	34	38
N=22	21	19	19	18	17	17	19	19	19	19

Legend

*G-1=Ahu Tepeu, grave 1

HE-10*=juvenile (approx. 12 yrs.) individual removed from statistical analysis

HE-6*=individual of potentially mixed ancestry: individual removed from statistical analysis

shaded=Murrill males (1968) reassessed as females and substantiated by Giles and Elliot, 1962. N=5

shaded*=Murrill male (1968) reassessed as female but unsubstantiated by metric analysis

Table 2
Male Crania

Measure- ment*	Easter Island Murrill '68	Easter Island Murrill- Reassessed	Difference (Mean in mm)
ML	N=21 187.2	N=14 190.6	+3.4
MB	N=19 132.2	N=12 132.9	+0.7
BB	N=19 141.7	N=12 143.4	+1.7
MF	N=18 94.2	N=11 95.6	+1.4
NA	N=17 67.4	N=10 68.5	+1.1
BZ	N=17 130.9	N=11 133.2	+2.3
NH	N=19 51.8	N=12 53.3	+1.5
NB	N=19 26.7	N=12 27.3	+0.6
OH	N=19 34.3	N=12 34.4	+0.1
OB	N=19 38.6	N=12 39.2	+0.6

*The measurements listed in this table and subsequent tables are: maximum cranial length (ML), maximum cranial breadth (MB), Basion-bregma height (BB), minimum frontal breadth (MF), upper facial height (nasion-alveolane) (NA), bizygomatic breadth (BZ), nasal height (NH), nasal breadth (NB), orbital height (OH) and orbital breadth (OB).

Table 3
Reassessed Female Crania (N=11)
Measurements in millimeters

SITE	ML	MB	BB	MF	NA	BZ	NH	NB	OH	OB
TE-8	177	129	---	(92)	---	---	---	---	---	---
TE-5	182	123	137	90	60	124	50	29	32	36
TE-4	175	---	133	92	62	(125)	47	24	33	37
TE-1- *G1	172	(123)	137	97	64	129	48	29	32	37
VI-7	172	133	134	86	(62)	---	45	25	32	(35)
VI-3*	184	137	144	88	63	127	46	26	32	37
VI-6*	185	129	137	94	67	(127)	49	26	34	38
TE-2*	179	132	141	92	60	(121)	47	25	32	36
HE-8*	184	129	139	94	66	(126)	50	28	33	38
HE-9*	182	(124)	142	94	(67)	125	50	25	35	37
HE-1*	185	128	---	91	70	---	49	26	35	40
N= 11	11	10	9	11	10	8	10	10	10	10

Legend

*G-1 = Ahu Tepeu, grave 1.

shaded * = Murrill males: reassessed as females N=6

Table 4
Female Crania

measurement	Easter Island Murrill 1968	Easter Island Murrill reassessed	Difference (means)
ML	N=5 175.6	N=11 179.7	+4.1
MB	N=4 127.0	N=10 128.7	+1.7
BB	N=4 135.3	N=9 138.2	+2.9
MF	N=5 91.4	N=11 91.8	+0.4
NA	N=4 62.0	N=10 64.1	+2.1
BZ	N=3 126.0	N=8 125.5	-0.5
NH	N=4 47.5	N=10 48.1	+0.6
NB	N=4 26.8	N=10 26.3	-0.5
OH	N=4 32.3	N=10 33.0	+0.7
OB	N=4 36.3	N=10 37.1	+0.8

Table 5
Male Crania

Easter Is- land: Gill 1981 (N=15)	Easter Is- land: Murrill 1968 (N=25)	Easter Island: Murrill Reassess (N=14)	Marquesas: Pietrusewsky 1976 (N=10)
ML 193.1	187.2	190.6	191.0
MB 137.2	131.8	132.9	139.0
BB 145.1	142.8	143.4	142.0
MF 97.8	94.2	95.6	98.0
NA 72.5	67.4	68.5	73.0
BZ 139.0	130.7	133.2	137.0
NH 55.2	51.7	53.3	56.0
NB 27.4	26.8	27.3	27.0
OH 36.3	34.1	34.4	38.0
OB 40.5	38.7	39.2	41.0
Female Crania			
(N=10)	(N=5)	(N=11)	(N=7)
ML 184.2	175.6	128.7	177.0
MB 131.7	127.0	138.2	133.0
BB 137.4	135.3	91.8	132.0
MF 92.5	91.4	64.1	93.0
NA 66.4	62.0	125.5	65.0
BZ 128.4	126.0	48.1	125.0
NH 27.7	26.8	26.3	25.0
NB 34.6	32.3	33.0	34.0
OB 38.3	36.3	37.1	38.0

Craniometric Comparisons

Table 6

Male Means

Sample

measurement	A	B	C	D	E	F
MAX LG	191	191	191	178	184	179
MAX BR	133	135	139	138	145	142
BAS BR	143	144	142	131	143	133
BIZ BR	133	136	137	135	138	141
FAC HT	69	70	73	(71)	72	75

Craniometric Comparisons

Table 7

Female Means

measurement	A	B	C	D	E	F
MAX LG	180	182	177	169	175	171
MAX BR	129	130	133	135	141	136
BAS BR	138	138	132	125	137	127
BIZ BR	126	127	125	126	129	131
FAC HT	64	65	65	(67)	68	(71)

SAMPLE LEGEND

A = Easter Island; Murrill reassessed, 1968
 B = Easter Island; Gill and Owsley, 1993
 C = Marquesas; Pietrusewsky, 1976
 D = Peru; Howells, 1973
 E = Hawaii; Snow, 1974
 F = Arikara; Bass 1964

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49 Briar Hollow Lane #1705, Houston, Tx 77027.

CORRECTION: in Dr Wilhelm G. Solheim's paper in RNJ 11(1) on pg. 27 (nine lines from the bottom), the text should read "... and for about 2500 [not 250] years with Taiwan." We regret the confusion.